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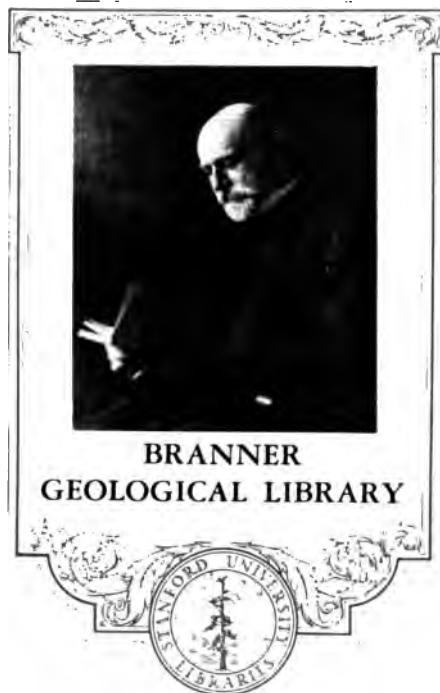
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REPORT
ON
BLACK HILLS MINES,
BY
LOUIS JANIN, M. E.

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HENRY W. TURNER

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REPORT
ON SOME OF THE
LEADING MINING CLAIMS
OF THE
Whitewood Mining District,
IN THE
BLACK HILLS,
Lawrence County, Dakota,
BY LOUIS JANIN, M. E.

Printed for the Shareholders of the Homestake,
Giant and Old Abe, Highland, Golden Terra,
and Deadwood Mining Claims.

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J. B. HAGGIN, Esq.:

Dear Sir—In accordance with your request, I herewith submit to you the results of my examination of the Mines under your control, in the "Black Hills" of Dakota.

The purpose of this report, as I understand it, is to give the shareholders in the various claims a general idea of the nature of their property, and some information of the facilities that exist for mining and milling.

As these mines are contiguous to one another, and are situated upon the main "Mineral Belt" in the Whitewood Mining District, Lawrence County, I have decided it best to include in one general description all those features—geological, mining and milling—which are common to the mines of this section, and then to give such details of each mine, independently, as will show the present state of its development and its individual characteristics.

Respectfully,

LOUIS JANIN, M. E.

SAN FRANCISCO, CAL., July 25th, 1878.

REPORT.

The Auriferous Mines of the Black Hills of Dakota have already become widely known—by name at least—notwithstanding that a few years only have elapsed since this region was a "*terra incognita*," even to governmental explorers. Prior to the expedition under General Custer, in 1874, and even of the subsequent geological expedition under Prof. W. P. Jenney, in 1875, the existence of gold in this region was more a matter of belief than an established fact; nor did these expeditions succeed in discovering gold in paying quantity. The mines which have given reputation to the Black Hills—the only paying mines which have yet been discovered—were found by the "prospectors" who would not retire from the field; who, in fact, could not be driven therefrom, even when the final governmental expedition was withdrawn.

These prospectors pushed their way into the northern portion of the Hills, in the immediate vicinity of the present city of Deadwood, and there made the discovery of those "placer" mines which first caused

the "rush" to the Hills. The discovery of the neighboring quartz veins, from which the placer mines originally derived their gold, soon followed as a matter of necessity: and to this day this section of the Black Hills still remains the only portion wherein mining is prosecuted with vigor and success.

The Black Hills form an isolated group of mountains, somewhat oval in shape, rising suddenly above the surrounding plains which spread in all directions to an immense distance. They lie between the North Fork and the South Fork of the Cheyenne River, with a general northwesterly course of about 120 miles in length, and a breadth which varies from 40 to 60 miles. This group of mountains is nearly bisected, east and west, by the 44th parallel of latitude, and, also, north and south, by the 104th meridian of longitude, which forms the boundary line between the Territories of Wyoming and Dakota. The entire area of the Hills is estimated at 6,000 square miles, of which the greater portion, including the belt of auriferous slates, is within the limits of Dakota.

Many of the ridges and summits of the Hills are covered with forests of pines. The dark-colored foliage gives to their rugged outlines a sombre hue which is in striking contrast to the lighter colors of the prairies, and makes the Hills a conspicuous object from distances of many miles.

Contrary to the prevalent opinion, these Hills were never the abode of Indians, but have always been regarded by them with superstitious reverence. Occasional trips were made to the mountains in search of lodge poles; but the storms which rage over the Hills in spring time, accompanied by vivid flashes of lightning and continuous crashing of thunder, made it evident to the Indians that this was the haunt of the evil one, and they have kept out of his reach. The white man's desire for gold has not harmed the Indian in this instance, and the miners can delve in their mines without any compunction of conscience.

THE GEOLOGICAL FEATURES

of the Hills are extremely interesting, and are worthy of a more detailed study than they have yet received. The facts which have been made known to the public are the results of the labors of Professor Jenney, who was in charge of the United States Geological Survey of 1875, and of his able assistant, the late Henry A. Newton, both of them graduates of the Columbia School of Mines.

The nucleus of the Black Hills, according to their report, consists of a belt of metamorphic rocks, mica schists, slates, and quartzites of Archæan age, which extends nearly the entire length of the Hills. This belt is completely surrounded by encircling layers of subsequent geological formations, which have a gen-

eral dip from the center to the level plains which surround the Hills.

The mica schists and slates are set on edge, and are metamorphosed throughout their length. The slates rest unconformably, in places, upon the schists, and are supposed to be of a later age. The mica schists occupy the southern portion of this belt, and the slates, chiefly chloritic, the northern portion. It is in this portion, the chloritic slates, that the auriferous quartz veins occur. The length of the belt of auriferous slates is about 50 miles, and its width is from 6 to 25 miles. Its course is with the general course of the Hills, and the slates dip to the northeast at a varying angle. The mica schists—to the south of the auriferous slates—are traversed by dykes of granite conformably to their stratification; but the age of these granitic dykes is yet undetermined. On the other hand, the auriferous slates, especially in the immediate vicinity of the mines which I have yet to describe, are traversed by numerous dykes of a buff-colored feldspathic porphyry, also conformably to the stratification, and which, in age, are more recent than the Cretaceous deposits. There are a number of veins in the northern part of the Hills which may have resulted from the intrusion of this porphyry; but the auriferous quartz veins of the Whitewood Mining District are older than the porphyry, and were probably caused by the folding of the slates and the metamorphic action which resulted therefrom.

Along the length and breadth of the area of auriferous slates, there are still broad stretches of overlying sandstone of the Silurian age, followed immediately by deep deposits of Carboniferous limestones. These have escaped the erosion to which the Hills have been subjected, and it is due to their presence, perhaps, that so few gold-bearing districts have been found. Wherever the slates have been uncovered, some veins of quartz are likely to be encountered; and, as the system of drainage has been across the course of the slates, it is not surprising to learn that gold has been discovered in nearly every cañon, or water-course, that leads out of the Hills.

It is not within the scope of this report to describe other mines than those I have lately examined. I therefore content myself by stating that the northern portion of the Hills have other veins of the precious metals besides the quartz veins in the slates. There are veins of argentiferous galena in Carboniferous limestone, accompanied by sulphurets and chlorides of silver; veins containing gold and silver in the Silurian sandstone, and also veins carrying gold in the porphyry itself, and in contact with porphyry and sandstone, or porphyry and limestone. There are extensive overflows of porphyry, which have more or less gold distributed throughout the mass. There are placer claims and cement-beds, and also ridges of auriferous gravel that need only an abundant supply of water to be worked to advantage.

Many deposits of iron are known to exist; and, in the Cretaceous beds adjoining the Hills, are seams of coal which promise to be of importance.

Of all the districts, however, the most interesting and important is the

Whitewood Mining District.

This is but one of a number of mining districts which have been formed in the Black Hills, but it is by far the best explored and best developed.

Within its limits there are numerous placer claims, cement-beds, and quartz-veins, all auriferous, and on all of which a great deal of work has been expended; and here, too, as I have already stated, are the famous quartz mines which have given to the Black Hills their reputation for mineral wealth, making their name familiar in all mining circles.

Within its limits, also, are the chief towns of the Hills—namely, Deadwood, Lead City, and Central City—having in the aggregate some 8,000 to 10,000 inhabitants.

Of these cities Deadwood is the largest and most important. It is situated at the confluence of the Deadwood and Whitewood creeks, and is about eight miles from the foot-hills. Central City is on Deadwood Creek. Lead City is on Gold Run, a tributary of the Whitewood Creek. These towns lie southwesterly from Deadwood, and a part of each of them is

upon the great mineral belt which crosses the respective creeks at these points. As a rough approximation it might be said that lines connecting these cities would form an isosceles triangle, having for its apex the town of Deadwood, and for its base that portion of the mineral belt which passes through Central City and Lead City. The sides of the triangle would have a length of about three miles, and the base a length of about one mile, in a direct line from Lead City to Central City.

Two stage lines connect Deadwood with the outer world. The one terminates at Sidney on the Union Pacific Railroad, and the other at Bismarck on the Northern Pacific Railroad. By the former the distance is about 270 miles, and by the latter 230. The time required to make the trip by stage is in the neighborhood of 50 hours, either way, and there is little to choose between them. The trip is undoubtedly fatiguing, but the accommodations are as good as might be anticipated.

The teams which haul freight to the Hills also pass over these routes. The charge for freight will vary with the demand for teams. As a rule, I believe it to be about $3\frac{1}{2}$ cents per pound, from Chicago to Deadwood. From San Francisco the freight to Deadwood is about $5\frac{1}{2}$ cents per pound.

The price paid for freight, although it adds materially to the cost of building mills, etc., is not so much

as mining operators of San Francisco have frequently paid in opening up new districts.

All the conveniences, and even the luxuries of life can be obtained in this section of the Black Hills. It is by no means the rough mining camp that exists in the imagination of many. On the contrary, it is one of the pleasantest of all the mining localities I have visited; and in no other district is justice more ably administered, or greater security afforded to life and to property.

Mining first began upon the placer claims in the immediate vicinity of Deadwood, in 1876. Soon after this, the cement beds were discovered and mills were introduced to crush the ore therefrom. The first attempt at vein mining was in 1877, and now, in the short space of two years, there are numerous mills engaged in crushing the quartz, and among them are several as fine and as large as any in the world.

GEOLOGICAL FEATURES, ETC. — The predominating country rock of this section of the great auriferous belt of the Hills is chloritic slate. This slate preserves its general characteristics throughout a wide extent of country, but there are a number of local variations, especially in the immediate neighborhood of the veins. There may be seen numerous bands of siliceous, micaceous, talcose, chloritic, hornblende and clay slates, irregularly alternating. A still more striking division of the slates is into bands which are highly colored

by the presence of ferruginous oxides, which are found in immediate contact with other bands which still retain the greenish tint due to the presence of chlorite, and carry undecomposed crystals of iron and arsenical sulphurets. It is probable that much of the difference existing in these bands of slates is owing to the difference in the materials existing at the time of deposition, but other changes must have resulted from the metamorphic action due to the folding of the slates, and from those causes which led to the formation of the veins.

The trend of the slates is to the west of north, and they dip at an angle of about 51 degrees to the northeast. Notwithstanding local variations, this dip is remarkably constant.

Before the occurrence of that period of erosion which led to the present configuration of the surface, the slates were covered with sandstone, limestone and overflows of porphyry. We have remnants of the former in patches or local depositions, and of the porphyry in the debris which covers the ridges and the hillsides to varying depth. We find, also, a number of reefs of siliceous slate which outcrop boldly above the surrounding country. These reefs are seamed with veins of quartz, both large and small, and, being of a harder material than the accompanying slates, they have withstood the erosion to a better degree. These are the "quartzites" of the miners.

They are found on either side of the mineral belt, at some distance apart, but generally parallel to the veins, and are held by some to indicate the outer limits of the slates wherein the ore deposits may be found; and miners—whose conclusions are often worthy of attention, although their theory may be at fault—anticipate as much benefit to the veins from the neighborhood of these reefs as California miners do to the presence of greenstone dykes, and, probably, for the same reason, namely, because a number of good mines have been found in their immediate vicinity.

Beneath a covering of sandstone and its overlying porphyry—sometimes resting on the quartz veins themselves and sometimes in depressions within their immediate neighborhood—we find a number of auriferous cement beds of varying thickness.

These beds consist of a highly ferruginous conglomerate of quartz and fragments of slate and of sandstone firmly cemented together, and carry a variable amount of gold. The beds were formed from the abrasion of the pre-existing quartz veins by the waves of the sea which rolled over the Hills in the Silurian period.

These cement beds have yielded a considerable amount of gold. Some claims are even now being worked to a profit, and the ore is crushed and treated in the same manner as ore from the veins. A limited quantity of the ore has yielded as much as twelve to fourteen dollars per ton, but the average result has

been about seven or eight dollars to the ton. The gold is sometimes, but not usually, visible in the ore. Its occurrence in the beds is very irregular. Its fineness is much higher than the vein gold, and this difference is supposed to have resulted from the action of sea water upon its alloy of silver.

The placer claims of this district are not worked now to any extent. They are situated along the gulches and on Deadwood and Whitewood Creeks, and mining is generally confined to the few months in the year when water is abundant in all the streams.

Passing through the slates in bands of varying thickness and covering the prominent elevations of a long stretch of country, we find that highly siliceous feldspathic porphyry which has already been mentioned. This porphyry occurs in dykes which have fissured the slates along the line of stratification, but have altered neither their strike nor their dip. These dykes are found in immediate contact with the veins, and even separate some veins from one another, but it is difficult to determine what influence, if any, they have had upon them; whether, in fact, they have caused a subsequent enrichment of the vein or not. The dykes near the veins carry no metals, although the porphyry of the neighboring districts is metalliferous.

The "Mineral Belt" is a vague term sometimes applied to the entire width and length of the auriferous slates, sometimes to that breadth of the entire width

wherein the quartz veins, or bands of interlaminated slate and quartz are found, and again, in a more restricted sense, to that line of ore deposits whereon the leading mining claims are situated. I shall now speak of it in the latter sense only, and therefore make no allusion to that neighboring line of deposits whereon the Caledonia group of mines is situated, and most of which is buried beneath porphyry or sandstone.

This belt, as I have stated, extends through Lead City and Central City, and is traced at intervals beyond these points, both northerly and southerly. There is work being done on the Pierce and other claims to the south of Gold Run, and on the Erin and Rhoderick Dhu to the north of Deadwood Creek; but all the main developments are still confined to that section of the belt which ~~lies between~~ ^{commences with} the claims of the Homestake Company on Gold Run and ~~the~~ ^{ends with} the Father De Smet Company on Deadwood Creek. This section of the main channel of ore—about one mile in length—is owned and worked by various companies formed in San Francisco.

The width of the channel of ore deposits has not been fully determined. In the neighborhood of the Homestake claims, but separated by stretches of barren slate and dykes of porphyry, there are a number of veins over a breadth of 2,000 feet of the country. The main portion whereon the best mines are located is, however, much narrower, and seldom exceeds 600

feet in width. Within this limit the belt consists of a series of ore deposits included within bands or zones of slate which are roughly parallel to one another. The workings of the companies are still near the surface, and here the different ore-bearing zones of slate are easily distinguished by their special characteristics, although they have certain features in common. They are sometimes separated by an intervening mass of barren slate, and sometimes the workable ore in one zone includes its entire width, and comes almost in contact with a similar deposit in an adjoining zone; yet their boundaries are plainly discernible. Even the miners notice the difference and speak of the "green slates" and the "red slates" — that is, the chloritic slate and the highly ferruginous mica slate. The sulphurets in the former are less decomposed than in the latter, in which the iron occurs chiefly as a hydrated oxide; but in each there is a considerable amount of magnetic iron.

These bands or zones alternate across the breadth of the belt, but they do not all continue with equal length. Some of them seem to thin out and to be replaced by others.

It is doubtful to my mind whether so sharp a distinction will exist between the zones when depth is attained, and the effect of weathering is less perceptible; but there is nowhere any evidence as yet of one zone gradually losing its characteristics and merging

into another, either in length or depth; some line of demarcation seems always to exist.

The ore deposits take, in some places, the form of true fissure veins of quartz, parallel to the stratification, and carrying free gold and gold-bearing sulphurets; and in others, the deposits occur in bands of interlaminated quartz and slates. As depth is attained—or even along the length of the vein—one large body of quartz may branch into separate seams of interlaminated quartz and slate, or several small veins of quartz may ^{unite} widen into a larger mass; but the ore deposits of one zone do not seem to unite with the ore deposits in another. The walls of the ore deposits or veins are likely to become sharply defined in depth, and the slates will be more siliceous.

The slates, zones and ore bodies have all the same general course of from 10 to 30 degrees west of north, and the same general dip of from 40 to 60 degrees to the northeast.

The gold is remarkably free and is worked to a higher percentage than the gold in the ores of California. On the other hand, the sulphurets (iron and arsenical pyrites) are much poorer than in many of the California veins. Here they run from 50 to 300 dollars per ton; but, in the Black Hill mines, the iron sulphurets contain but 5 to 12 dollars, and the arsenical sulphurets from 20 to 35 dollars to the ton of concentrations.

Nevertheless, the free gold seems to be derived exclusively from these sulphurets; and yet a ton of quartz ore is usually much richer in gold than a ton of concentrated sulphurets. The percentage of sulphurets in the veins will greatly increase with depth, but there is as yet no corresponding decrease of the percentage of free metal. The lowest levels supply the richest ore yet worked. The quartz in the veins is usually much fractured. In the slaty veins especially, the body of ore is cut by innumerable seams with and against the stratification, and these seams are lined or coated with hydrated oxide of iron often rich in gold. The solid bodies of quartz are not so rich, as a rule, as the fractured bodies; and these latter are often highly colored by the presence of iron oxides.

The free gold is generally in a finely divided state, but there is a notable percentage which occurs in threads of one-eighth or one-quarter of an inch in length.

Its fineness, as obtained in bullion from the mills, runs from 800 to 850; and the fineness of its alloy of silver varies from 100 to 150. Some observation seems to prove that a portion of the deposits which lie up hill have been washed into the upturned edges of the slates of lower deposits and thereby enriched them; for the surface dirt is sometimes richer in gold than the ore immediately beneath; and this gold, either from the action of sea water, or from some other cause,

is of a finer grade than the gold in the veins. In general, however, the fineness of the gold is very uniform throughout the length of the channel, whether it is found adhering to the slate or to the quartz, and there is not that difference that is often found elsewhere in neighboring chimneys of the same vein.

The veins follow the configuration of the surface of the belt as it passes from creek to creek, and the ore is found at the highest and lowest elevations—which vary as much as 500 feet in altitude—and throughout its length. The width of the different veins will vary from 10 to 100 feet and upwards. One vein of the Homestake, consisting of interlaminated slate and quartz, is breasted out for a width of 150 feet, and cross-cuts show it to be even wider. This is on one end of the belt. At the other end one of the veins of the De Smet mine is a solid body of quartz, carrying free gold and sulphurets, 93 feet in width. The intervening claims have also great breadths of ore, which will be referred to in the description of those mines; and one of these has a measured breadth of over 160 feet.

Owing to the abundance of ore above the tunnel levels and near the surface—due to the unusual widths of the veins—years will elapse before a great depth can be attained in any of the claims. It would be premature, from the present shallow developments, to venture an opinion of the probable behavior of the

deposits at such depths. They will doubtless vary in size and in the grade of the ore, and the proportion of sulphurets may increase. The veins will widen at times and become narrow at others, both in length and in depth; in fact, they will behave as veins generally do, and especially such veins as are parallel to the stratification. Compared with other veins, however, we have here one of the most uniform and longest stretch of gold-bearing deposits that has occurred in the history of mining. I know of no mines which are similar to these on the western coast of America. The majority of the California veins are in slates of Jurassic age, and therefore much younger than those of the Black Hills. These latter, with their overlying conglomerates, have points of resemblance—especially in their age and mode of occurrence—to those of Dahlenega, and to others on the Appalachian gold belt, and more particularly to some of the famous gold mines of Brazil; but the results which have been already obtained from a limited section of these mines of the Black Hills, would seem to indicate a value which is far beyond the value of these other mines.

MINING AND MILLING FACILITIES.

The cost of mining and milling the ores from the various claims is generally lessened by their very favorable topographical position.

The mineral belt passes over two elevations which slope in each direction along its course. All of the

claims are so located that the bodies of ore can be worked by means of tunnels which gain depth as they are driven ahead, and through which the ore is delivered immediately into the bins of the respective mills.

The cost of the necessary supplies for the mines and the mills is not more, if as much, as for the majority of mines in California, and everything that is desired can be had in abundance.

Wood for fuel is delivered at a cost of \$4.75 to \$5 per cord. With increasing demand, there will be a corresponding increase of facilities for its delivery, and therefore the longer distance from which it must be hauled each year will not materially affect the price. It may be found advisable at some future time to make use of the coal which exists in the Cretaceous beds of the neighboring plains, and which, with improved facilities, might be delivered to the mills at a reasonable price. This coal is of good quality, and the beds are seemingly extensive. Its existence will always tend to keep the price of wood within reasonable limits.

Timber for the mines has not been in much demand, but as depth is attained the roof and sides of the veins must be supported. The price will vary from 20 to 30 dollars per thousand feet.

Although the fall of snow is quite heavy during the winter, it disappears rapidly with the rain-storms of spring, and the creeks soon run dry. This has led to

the formation of water companies, of which there are several in the district.

The boldest and most expensive of these undertakings is that of the Wyoming and Dakota Water Company, which proposes to bring water from Spearfish Creek. A number of tunnels will be driven through the hills on the route of the ditch, and the water will be carried across the depressions by means of inverted syphons. Some time must elapse before the enterprise can be successfully completed. It was planned, and is now being directed, by Mr. A. J. Bowie, M. E., who is also the able Superintendent of the Father De Smet Mine.

Other ditches supply water to various points; but the mines and mills of which I write are dependent upon the Pioneer Ditch, which takes its water from the head of Whitewood Creek, and supplies the mills at two dollars a week per stamp.

The wages paid for skilled mining labor is three dollars and fifty cents per day. For surface and for ordinary labor it is from two and a half to three dollars. Mill hands receive three dollars a day, and mechanics from four to five dollars per day. This is quite enough, and the best labor of its kind should be had for such prices, as the cost of living is not high.

The total cost of mining and milling, including the transportation of the ore, will necessarily vary with the different conditions that exist. This total cost is

now between two dollars per ton of ore crushed, as at the Deadwood Mine, and about four dollars per ton as at the Homestake Mine. The cost of mining alone will depend upon the size and position of the ore bodies, the amount of assorting—if any should be required—the amount of timbering, and upon the amount of water that may be encountered in depth. To this must be added the cost of management, of prospecting, and of incidentals.

The cost of milling remains nearly constant, and depends upon the price of labor, of fuel, and of castings. The cost should be kept as low as one dollar or one and one-quarter dollars per ton on the average.

The delivery of the ore to the mills is another item of cost, but this is not felt very much. As the ore is hauled directly along tramways from the chutes of the mines to the bins of the mills, this expense is chiefly incurred in loading and unloading the cars.

Owing to the great quantity of ore that the mills (200 stamps) of the Homestake Mine will require, say from 400 to 500 tons daily, the company has ordered a Baldwin locomotive of 10,000 pounds weight to haul the ore to their two mills, and will thus dispense with a great force of men and horses.

METHOD OF WORKING.—For the benefit of those of the shareholders who are not familiar with the details of mining and of milling, I give a concise description of the leading features

The principle involved in mining is pretty much the same the world over. Having first studied the nature of the ore deposit, as to its probable continuance in depth, its size, and its quality (as low grade ore must be worked on a larger scale to produce certain returns than ore of a better grade,) then the problem becomes one of extracting this ore at the lowest average rate per ton, but always with due regard to the safety of the workmen, and the future requirements of the mine. As long as mining is confined to the surface, no extensive appliances are necessary; but as depth is attained, shafts must be sunk, the bodies of ore must be cut by drifts to obtain a number of points of attack, and hoisting works must be erected of sufficient strength and capacity to extract the ore in the required quantities and from increasing depths. Thus within a few months a company may expend on "dead work" and on the "plant" a large amount of money for the requirements of the mine in after years. This "dead work" cannot always be delayed until just when it is required.

Most of the mining is now of the simplest description. The ore is extracted from large chambers, and then loaded into cars and transported directly to the mills.

When timbers are required they are placed in the chambers to prop the sides and the roof so that the gangways shall not be closed, and that no ore may be lost by the caving of the walls.



The Homestake and the Giant and Old Abe Companies are now engaged in sinking shafts and erecting hoisting works for deep mining, and the other claims will do the same as soon as advisable.

MILLING is the term applied to the process of extracting the gold from the ores, and it is one of the simplest of metallurgical processes.

All of the mills are run by steam power. They are so situated that the ore is received from the mines into the upper story. The cars discharge their contents over an inclined grating called a "grizzly," which permits the fine stuff to fall directly into the bins, or hoppers, below them; the coarse pieces slide down the grizzly into a Blake's crusher, where they are reduced to a proper size, and then drop into the bins.

The bins discharge the ore into "self-feeders"—a hopper-like arrangement, regulated by machinery—which allows the ore to pass very gradually, but faster or slower as may be required, into the mortars or batteries, where the ore is pounded by stamps into the required fineness, and is then discharged through screens over copper plates with amalgamated surface. Water is constantly fed into the battery during the stamping, and quicksilver is added to pick up the gold from the crushed ore. Some of the amalgamated gold accumulates in the battery and this is taken out about once a month; the remaining portion of the gold is

deposited on the plates, and these plates are cleaned up twice during the month. About one-third of the total yield is obtained from the batteries and above two-thirds from the plates.

When the crushed ore leaves the copper plates it is called "tailings"; and to extract the particles of gold that may be escaping in these tailings, they are made to flow along sluice boxes with copper plates on the bottom, and which are supplied with riffles or traps to catch the gold, which settles by virtue of its superior gravity.

Some of the mills contemplate the erection of concentrating machinery to save the sulphurets and particles of amalgam that may be escaping from the mills. It is very likely that blankets will finally be used instead of machinery, as perhaps better results can be obtained by the use of blankets, and at a less expense. The wire, or thread-like gold, sometimes rolls along with the current, when the pieces lie with their edge to the flow, and this gold, as well as the extremely fine gold that may float off, would be caught in the nap of the blankets.

After the amalgam has been collected from the batteries and from the copper plates, it is cleaned of the adhering particles of iron and of sand, and is then retorted in cast-iron vessels. The quicksilver is thus driven from the gold and is caught to be used again in the mills. The gold is then taken from the

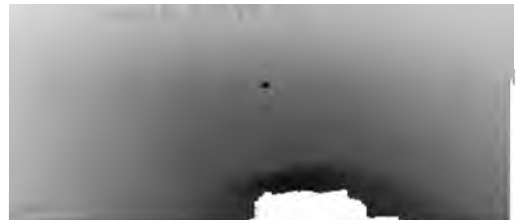
retorts and melted into bars, which are weighed and assayed with sufficient accuracy to ascertain their approximate value. These bars of gold are shipped by express to Messrs. Lounsbury & Haggin, the New York agents of the companies, and by them deposited in the U. S. Assay Office. The proceeds of these bars, after deducting all charges for freight and for melting and assaying, etc., is placed to the credit of the respective companies, and a memorandum of the results of each shipment is sent to the home office in San Francisco.

I believe that there are upwards of seven hundred stamps in constant employment on ore from the various deposits in this camp. Some of the mills are built upon the Colorado plan, and others upon the California plan; but the California companies have all adhered to their own system, with such slight modifications as were required by the nature of the ore.

The machine work for the large 80-stamp mills of the De Smet Company, and for the two mills of the Homestake Company—one of 80 stamps and one of 120 stamps—were designed and constructed in San Francisco. The 60-stamp mill of the Deadwood, and the 60-stamp mill of the Golden Terra were constructed in Chicago, from designs furnished to the foundry by the constructing engineer, Mr. R. D. Millet, who has general supervision of all the machinery of the companies. The mills are substantial and complete in every detail.

The relative merits of the Colorado system and the California system of mills has been a matter of dispute, and I believe it is still a matter of interest to many. Each was probably the outgrowth of the experience acquired in working a given description of ores; now that mills of each description are here working on ores from the same deposits, this question might be settled if some "expert" would undertake the examination.

My own observations were somewhat superficial, and confined to a few mills, and these of a different number of stamps. The difference I noticed was as follows: The Colorado stamps weigh about 600 pounds each; they drop from 12 to 16 inches, and their speed is from 30 to 40 blows per minute. The California stamps weigh from 800 to 850 pounds, the drop is about eight inches, and the speed about 85 blows per minute. This difference enables a Colorado mill to be constructed of lighter machinery and at a total cost much below that of a California mill of the same number of stamps, as the wear and tear of the working parts is considerably less. The rapid and heavy blows of a California mill necessitates heavy machinery and a costly construction of the frame-work. A stamp in a California mill will, of course, crush more ore than the lighter and slower stamp of a Colorado mill; but the difference in the amount crushed per horse-power developed by each,



is in favor of the Colorado stamp; and this difference is even greater per total power required to run the mill, as the intermediate gearing in the one is much lighter than in the other, and less power is lost in friction. But the heavier machinery of the California mill gives it a longer life; and the difference I have indicated is more observable in working the light, slaty ores, than in working the compact quartz ores. The rapidity with which the pulp is discharged from the mortars seems also to depend upon the kind of agitation which the waters receive from the falling stamps, the agitation being more violent in the shallow mortar of a California mill than in the deeper ones of the Colorado mills. In the former some coarse particles of sand are kept in suspension, while in the latter these particles rest upon the dies until pulverized. In outward appearance and in their general arrangement, the Colorado mills of the Black Hills cannot compare with the California mills.

THE MINING CLAIMS

which are described in the following pages are—

- The Homestake Mine.
- The Giant and Old Abe.
- The Highland Mine.
- The Golden Terra.
- The Deadwood Mine.

The relative position of these various claims can best be seen from the accompanying maps and sections, in which I have also endeavored to represent a number of details of interest. The only prominent omissions in my description of the chief mines along the belt are the De Smet, which is under the control of other parties, and the Caledonia, which is not on the main line of deposit. Both of these claims are incorporated and owned in California. It is to the enterprise and to the capital of Californians that the mines now owe their prominence. Money flowed like water long before there was positive proof of the present wealth of the claims, but the results have already justified the opinion of the experts who first recommended the investment of capital.

The deposits were recognized as likely to prove extensive but of a low grade of ore. And it was judged that none but the largest and best constructed mills should be erected. This is not a "poor man's" camp. Not a claim on the belt can be worked with satisfactory results on a basis of 20 or 30 tons daily, for all the profits from such an amount of ore would be required for the monthly development of the mine.

The attention of California capitalists was first attracted to the Hills in the spring or summer of 1877, but it was not until late in the fall that a thorough examination was made. The mines were then visited by Mr. George Hearst, acting for himself and for

Messrs. Haggin and Tevis, and by Mr. Henry Janin, M. E., for himself and associates. The first claim bought by these parties was one of the locations which now belongs to the Homestake Company. From that time to the present, Messrs. Haggin and Tevis, under the advice of Mr. Hearst, have been acquiring claims and uniting with others to form companies. It is easy to see now that their heavy investments were judicious and will bring in excellent returns; but in those earlier days there must have been an abundance of faith.

The central or home offices of the claims I have mentioned in the above list are in San Francisco. Each claim has its corps of employés who reside at the works, and the managers report weekly and monthly to Mr. J. B. Haggin, from whom they receive their instructions on all matters of importance. The general management of all the claims is intrusted to Mr. George Hearst, who has long been prominently connected with the mining interests of the Pacific Coast, and who has been identified with the organization of many leading enterprises.

The PLANS which accompany this report were compiled from various existing maps of the mines, as well as from some original surveys made for myself. The locations have been colored in such a manner that those which are claimed by different companies can be readily distinguished from one another. It must

be understood, however, that locations innumerable have been made in this section of the Hills, many of them, doubtless, for the purpose of confusing title, and thus, in one or two instances, a portion of the ground included in a company's claims on the maps hereto attached is still in dispute. The more prominent conflicting locations are indicated by their surface lines. A majority of these "adverse claims" have been purchased, and the others will be settled sooner or later.

THE SECTIONS which accompany the plans are chiefly designed to show the configuration of the surface and also to indicate the facilities which exist for mining by means of tunnels. A few geological sections are given of that portion of the main belt included within, or adjoining, the Homestake claims. In this examination I was greatly assisted by Prof. W. P. Jenney, and I regret that the limited range of this report prevents me from giving other details of interest. The conclusions I have given in the foregoing are based upon superficial developments only. With increasing depth and more extensive explorations, many features now obscure will become plain; and then, it is to be hoped, these mines will be described with a fullness which is due to their position among the mines of the world.

The Homestake Mining Company.

This company was incorporated under the laws of the State of California, on the 5th day of November, 1877, with a capital stock of \$10,000,000, divided into 100,000 shares of \$100 each.

The mining claims of the company are situated on a fork of Gold Run Creek, near the southern end of the developed portion of the mineral belt. The position of these claims in relation to one another, as well as to others on the belt, is indicated upon the accompanying maps. The claims possessed by the company before incorporation were the Homestake and the Golden Star locations. To these have been added the larger portion of the Nettie claim, and the westerly portion of the Gold Run.

The former two are the most developed of the claims, and the only ones which I shall have occasion describe in detail. The Nettie has been developed by a few prospect holes, only, enough merely to determine the presence of some seams of good ore. The Gold Run has only been worked within the limits of the other locations.

The size of the Homestake location is 1338 x 154 feet; that of the Golden Star is 1360 x 240 feet— at the south end of this claim the width is 300 feet.

The location of the claims is not exactly along the

course of the ore bodies or veins. The ore bodies, as I have elsewhere stated, are parallel to the stratification of the slates, and have, in the Homestake claims, a course of 15 to 22 degrees west of north. The course of the locations themselves is more nearly 38 degrees west of north.

Across the width of the locations there are a number of nearly parallel bands, or zones, of ore-bearing slate and quartz, as well as parallel dykes of porphyry. All these have a northeasterly dip of about 51 degrees. The aggregate width of the separate bands of pay ore in some portions of the claims is over 250 feet. These bands of pay ore are, near the surface, interlaminated belts of slate and quartz, which give way, in ~~places~~^{depth}, to solid bodies of quartz more or less fractured, and ~~which~~^{which} have oftentimes a slaty structure.

The monthly production of ore required for the 80-stamp mill of the company is some 5,000 tons. This amount, as soon as the new 120-stamp mill is in running order, must be increased to at least 12,000 tons.

To be able to extract and to handle so large a quantity of ore, the mine must be well opened, and the works of development of all kinds must be kept in advance of all requirement. The necessary steps for this purpose have long since been taken. The company has already extracted nearly 70,000 tons of ore, and has in the meantime thoroughly prospected

their claims along a great portion of their length and breadth and to a depth of 75 feet perpendicularly below the upper level. There is now a vertical shaft 165 feet in depth, and an incline shaft 115 feet in depth. These shafts have been very properly placed at the eastern side of the claims, as the dip of all the ore bodies is towards them.

The works of development are being pushed ahead with vigor, and are constantly adding to the amount of ore which is technically considered as "in sight." This amount, already very large at the time of my personal examination, has been considerably increased by subsequent developments. According to recent measurements made by the superintendent, there are now in the upper works, 201,147 tons; and between the two levels, 346,784 tons, making a total of 547,931 tons. This amount is sufficient to supply the two mills of the company for the ensuing four years. As the lower prospecting drifts showed good ore along the bottom, it is evident that the ore bodies must hold out to greater depth. The quality and extent of these bodies in depth will soon be proven by the continuation of the present system of development.

The vertical shaft and the incline shaft are each supplied with the necessary machinery for hoisting and pumping. These are sufficiently powerful for all the work that may be required of them for years to come. The company is also supplied with air compressors and Ingersoll drills for rapid mining.

The two shafts are connected by a drift; and from this drift, at various intervals, there are a number of cross-cuts to the west, which are carried through the alternating bands of porphyry, slate and veins; and in each of these veins a considerable breadth of ore was developed. The ore was sampled frequently, and shows the same variations in its quality, or grade, that were met with in the upper works, 75 feet above. In one of the drifts—that which was driven to the west, just north of the vertical shaft—the quality of ore was, on the average, much better than in any other drift in the mine; and it is probable that if the ore of this section was worked by itself, the yield would be fully double of the yield of the ore in the past. It is likely, however, that the system of mining heretofore followed will be adhered to in the future; that is to say, in supplying the mills, the ore will be taken indiscriminately from all portions of the mine, and the low grade ore will be mixed with high grade in varying proportions. Oftentimes poor ore of a low grade must be extracted in order to reach the good ore; and when this ore is once extracted, it is as cheap to deliver it to the mill as to throw it over the dump. It should, therefore, be worked up as fast as extracted, so long as the yield will more than cover the cost.

The value of the ore “in sight” can only be estimated from the daily samples taken from the pros-

pecting drifts. These, of course, cannot represent accurately the value of the mass of ore intervening between these drifts; but they are sufficiently reliable as a proof that the ore is or is not pay ore.

The prospecting drifts in these claims have developed the fact that, while all the ore "in sight" is pay ore, of a varying quality, a large portion is of a value much above the average. The company is thus assured, from the present developments, of a prosperous career of four years, and there is every indication that this time must be greatly prolonged.

All of the veins which exist in these claims have been cut by the various prospecting works, and each has contributed to the amount of ore which has already been reduced. The four "Sections" given on Map No. 2, show how these veins appear in different parts of the claims. These sections are taken across the vein at varying altitudes, and over a length of some 600 feet. A short description of ^{the veins} ~~them~~ may be of some interest.

1. Commencing on the westerly side of the surface works, we have the "Golden Star" vein. This is a broad mass of interlaminated slate and quartz which has been worked over a width of 150 feet, and has been prospected along its length, at different altitudes, to the northerly end of the claims, and even into the claims beyond. Wherever it has been worked it has yielded an excellent grade of ore. A narrow band of

chloritic slate separates the mass into two parts, but this slate is itself impregnated with more or less gold, and does not form a perfect division in the workings of the "Golden Star" claim. Towards the north, however, and at a greater altitude, this vein becomes narrower. The ore is found concentrated into solid, fissure-like ~~veins~~^{seams} of quartz, while the intervening mass of slate is nearly or entirely barren.

2. Adjoining the "Golden Star" vein to the east is the Homestake vein. This is separated from the foregoing by a band of barren slate enclosing an irregular dyke of porphyry. This porphyry dies out, a short distance north of the open cut, in the upper levels. The width of the vein in the open cuts is about 25 feet; but in going northerly it is found to widen rapidly to a width—as in the Highland claim—of over 160 feet. The entire breadth of the vein in the southern portion consists of high grade ore. In the northern portion, it is found to contain ~~veins~~^{seams} of excellent ore, varying in width from 3 to 30 feet, which are separated from one another by irregular bands of "iron" slate. The slate itself is impregnated throughout with gold in varying proportions, and is seamed with little veins of quartz. The slate which is in immediate contact with the ore bodies, is often rich enough to extract for ore. The slate is chloritic and micaceous, and heavily charged with magnetic iron. It is stained a deep

brownish-red color by the decomposition of the iron, and is clearly distinguished from the mass of slate by which it is separated from the Golden Star vein.

3. To the east of the Homestake vein is the so-called "Young's" vein, or "Discovery" vein. It has a dyke of porphyry for its foot-wall and another dyke of porphyry for its hanging wall. This vein is irregular and is broad or narrow according as the two walls approach one another. In some places it opens into chambers of a width of 40 feet, and in other places—as shown in Section No. 2—it disappears entirely. It appears again at higher altitudes, as in Sections No. 3 and No. 4. It has been partially prospected in depth and at various points along its length. The grade of its ore has been found to vary between wide limits, but some of the richest that the mine has produced was taken from it.

4. Next to the "Discovery" vein, is the "Incline" vein, so called because the incline shaft is carried down on its dip. This vein, like the preceding, is also enclosed within dykes of porphyry, but it remains strong at all points where it has been prospected. Its value is not uniform. In the upper levels, the vein is slate, or interlaminated slate and quartz; in one of the lower cross-cuts, however, it is seen that, in depth, the quartz is concentrated into a broad belt enclosed in slate. In this particular instance the quartz is not

so rich as the slate on either side of it. This, indeed, may be said to be the rule in the southern end of the belt; and even when the quartz is found to be rich, it is usually much fractured and somewhat slaty in its texture.

5. Following the Incline vein to the east is the Old Abe vein. There has been no development of this within the limits of the Homestake claims, but its course, as indicated in the neighboring property, shows that this vein must come into the southern portion of the Homestake ground, and thus adds to the prospective wealth of the company's claims.

From an inspection of the plan it will be seen that the claims are located upon the spur of a hill which rises in going northerly. This fact has influenced the manner of working the mine. Open cuts were made upon the veins, and these, in being advanced as fast as the ore was extracted, gained rapidly in depth beneath the surface. Beyond the open cuts the ore is chambered out; and from the end of the chambers there are various prospective drifts to the end of the claims. Besides these drifts, the veins are cut from east to west by the Golden Star tunnel, and also by other tunnels in the claims to the north.

To the south of the open cuts the property has been prospected only by a shaft of no great depth. This portion of the claim is covered by surface soil and some débris from the hills above.

Nearly all of the surface of the locations is covered with porphyritic débris as well as by an overflow from one of the dykes. The débris is found to be intermixed with ore, but the veins seldom show an outcrop.

It is evident from what I have stated in regard to the developments, that the company has lost no time in opening up its claims. These works are prosecuted with such rapidity that a description of them as they existed at the time of my examination is almost useless. The results already obtained, however, have been most flattering, and fully justifies the erection of the new mill of 120 stamps, in addition to the one already built of 80 stamps. The production hereafter will greatly exceed that of the past. Ore of a low grade can be worked to a profit. In fact, there will be no need of any assorting of the ore. All that is met with can be mixed and sent to the mills and be reduced to a profit.

All the appointments of the company are first-class in every particular. It would swell this report to a great length were I to give a detailed description of every department of the works. I can only refer to them.

The transportation of the ore was effected hitherto, in wagons drawn by horses. These are to give way to

a Baldwin locomotive running on a track from the two shafts to the mills.

The machinery for the mills was constructed by Prescott, Scott & Co., of San Francisco. The mills are built after the California pattern. The first mill, having 80 stamps, was constructed in 1878, and started upon the twelfth day of July of that year. The second mill, of 120 stamps, was commenced in the spring of this year. Both mills are complete in every detail, and will crush from two tons to two and a half tons per stamp. They are run by steam power.

The company owns a machine shop, with all the necessary appliances; also, a carpenter's shop, assay office, store-house, office and dwellings, etc., etc.

A saw-mill was bought having a capacity of 4 000 feet daily. This saw-mill has been the means of maintaining at a reasonable price the lumber and mining timber used at the various establishments under the control of Messrs. Haggin and Tevis. The company also owns a number of oxen, mules and horses, which have been of use in hauling wood purchased at various outlying camps, and these have proved effective in keeping down the price of wood for fuel.

A large quantity of wood is now in the wood-yard, and stores of all kinds are kept in an ample supply.

I give below a synopsis of the results obtained from the ore that has been crushed from the commencement of operations by the company to and including the last shipment for the month of June of this year. This, I think, will give a clear idea of what may be anticipated hereafter when both of the mills are at work, and when the amount crushed will be increased from the present rate of about 5,000 tons monthly to 12,000 tons; this being the anticipated capacity of the two mills.

Previous to the completion of the 80-stamp mill of the company, the work at the mines was chiefly confined to the development of the ore bodies, in order to facilitate the extraction of the large amount of ore that would be required for this mill. In the meantime, during the months of May and June, 1878, there was shipped to other mills a total amount of 2,466 tons of ore, which yielded a net product of \$19,040.76. The 80-stamp mill was completed in July, 1878, and commenced to crush on the 12th day of that month. It has since been in constant operation, losing only such time as was incidental to the starting of a new mill. The yield of the ore in "outside" mills, as given above, may be taken to represent the additional amount that would have been obtained from the new mill had it started on the first of July instead of the twelfth; and the total production of all the ore worked, as given below, may be assumed as the result of one complete year's work.

The results obtained were as follows:

Total amount crushed to June 30, 1879.....	67,069 tons.
Yield, bullion.....	<u>36,020.67 oz.</u>
Value, Gold, per oz., \$17.138 Total.....	\$610,506 31
“ Silver, “ .18 “ 	6,486 11
	<u>\$17.31</u> <u>\$616,992 42</u>
Net yield after deducting all charges for expressage, insurance, coining, etc.....	\$605,668 54
Average net yield per ton.....	9 03
Amount paid in dividends, 7 months @ \$30,000 ...	210,000 00

The amount of ore crushed each month during the past year has varied from 4,752 tons to 7,707. The capacity of the mill, working on the average ore of the mine, is estimated at 5,250 tons monthly, but the amount is sometimes increased when an unusual quantity of soft, disintegrated ore is put through the batteries.

The new 120-stamp mill of the company is completed and will start up sometime during the month of August. The amount of ore required for the two mills will vary with the hardness of the ore and the number of stoppages that may occur; but it is safe to assume that the quantity will be at least 12,000 tons monthly, and it may average 150,000 tons yearly.

I have elsewhere stated that the ore has been extracted from all parts of the mine. The “Golden Star” and the “Homestake” veins have furnished by

far the larger proportion, and these veins have been worked out completely, in places, from the surface to the bottom of the upper levels. The ore was generally intermixed, but it was occasionally found advantageous to extract an unusual quantity from some one place during a given month. This has caused a fluctuation in the yield of the average monthly value of the ton of ore. It has varied from \$6.50 to \$11 85 per ton. The total monthly production has been nearly uniform.

The expense of mining and milling has also varied at times. It is estimated that the cost will be reduced when both of the mills are at work, as a large quantity of ore can be handled proportionately cheaper than a small quantity. In the past the company has disbursed large sums for the construction of their mills and for the necessary hoisting works, shafts, buildings, etc., which are now good for all time.

A late examination of the books showed the following as the average monthly cost at the works:

Labor charged to mill account, including transportation of the ore.....	\$4,003 93
Labor charged to mine account, including prospecting, sinking shafts, etc.....	7,943 53
Mill supplies—wood, water, castings, etc.....	5,359 96
Mine “	2,805 56
	<u>\$20,112 98</u>
Estimated average capacity of mill.....	5,250 tons.
Cost per ton on above basis.....	\$3 83

In order to include the sundry items of expense that constantly arise, the cost per ton for the past year may be placed at \$4.00.

It is very likely that the working expenses may decrease in the future. Assuming, however, that the cost will amount to \$4.00 per ton, and assuming, further, that the total amount to be crushed in the two mills will reach 150,000 tons during the year, and that the yield of the ore in the future will remain as in the past, then the year's profit will be \$750,000.

Even if the value of the ore should fall to the lowest monthly average obtained in the past, say \$6.50 per ton of ore, the profit for the year would still be \$375,000.

The estimated quantity of ore in sight assures to the company a prosperous career for the next four years. Every day's work in the prospecting drifts is adding to this amount, and the size and strength of the veins would indicate a period of prosperity far beyond the time above mentioned.

The Giant and Old Abe Mining Company.

This company was incorporated on the 25th day of September, 1878. The capital stock is \$10,000,000, divided into 100,000 shares of \$100 each.

Since the date of its incorporation the company has purchased a number of the locations adjoining those which they already possessed, and have thus settled a number of disputed titles. Several of these locations overlap one another, and a portion of the ground claimed by the company—the Gold Run, for instance—is still adversed by other parties; but all conflicting titles are on a fair way of adjustment.

The locations form a group which lie to the east of those belonging to the Homestake Company, and they follow, in the main, the general trend of the ore deposits.

They are situated upon the southerly slope of the high divide which separates the waters of the Gold Run Creek from those of the Bobtail and Shoemaker gulches. These latter are tributaries of Deadwood Creek.

Mining operations have not been actively prosecuted upon these claims. There is by no means the same extent of development that is found in the Homestake, Golden Terra, Deadwood, and other prominent mines in the Hills. The total production of ore

since the mines passed into the possession of the present company, up to the first day of this month, amounts only to 6,500 tons; and all the work that was done by former owners was confined to the surface. A deep shaft with three compartments is now being sunk; when this is carried down the required distance, a number of drifts will be run to the ore bodies, and then, it is presumed, the ore will be mined in quantities. The mill belonging to the company has 30 stamps of 650 pounds each. This mill was easily supplied with ore from one of the veins by a few workmen. All other work has been chiefly for the purpose of opening up the mine for future requirements.

In the following I give a description of the leading features of the principal locations as they existed at the time of my examination. Their relative position is indicated upon the accompanying Map No. 2.

Within the limits of this broad belt of mineral bearing slates which extends to the east of the Homestake claims there are, as in the Homestake ground itself, a number of parallel ore seams alternating with dykes of porphyry. It is not yet known how far to the east this auriferous belt continues, as this section of the district has never been prospected to any extent. The surface itself is covered in places with cement and porphyritic debris.

All of the claims of the Giant and Old Abe Company are within the breadth of the belt, and in each

of them ore will be found in greater or less abundance. The following is a list of the claims:

Old Abe.

Palmetto and American Flag.

Giant.

Amicus.

Rothschild.

The works of development have been chiefly confined to the Old Abe proper, and to that other portion of the Old Abe location which was formerly claimed by the Palmetto and American Flag. The former owners of these properties extracted therefrom a considerable amount of ore. A large chamber was excavated in the Old Abe vein, and the ore was followed down to a depth of some 45 feet. On this level a main tunnel was driven to the ore bodies and some cross drifts were run to the east. The present company continued these works of development, but ceased to extract any more ore than was necessary to supply their little 30-stamp mill. A new shaft—the Farish vertical shaft—was sunk near the Homestake line, and drifts were run to the north to cut the ore body that was worked above. This drift is some 65 feet below the top of the shaft. Another drift was run to the east to cut into the seams that were found in the upper portion of the Palmetto ground.

The results showed that the large body of ore which existed near the surface on the Old Abe became di-

vided in depth into three nearly distinct seams of auriferous quartz, each of which varied from ten to fifteen feet in width. In places, the intervening mass was rich enough to extract and send to the mill; but, as a rule, the milling ore was confined to the three seams. The ore has retained about the same average value from the surface workings down to the lowest level.

A partial statement of the yield obtained from ore extracted by the former company before September, 1878, is as follows:

Amount of ore worked.....	11,486 tons.
Amount produced.....	\$108,761 21
Yield per ton.....	9 49

The yield obtained by the present company from sometime in September, 1878, to the first of July, 1879, was as follows:

Amount worked.....	6,532 tons.
Yield, in bullion.....	3,217.11 ozs.
Value, Gold, per oz., \$17.16	Total.....\$55,101 25
“ Silver, “ .15 “	491 07
	<u>\$17.31</u>
	<u>\$55,592 32</u>
Net yield, deducting all charges for expressage, insurance, coining, etc.....	\$54,627 41
Net yield per ton.....	8 36

The difference in the average yield of the two lots is due chiefly to the fact that the present company has

sent to the mills some of the low grade ore that came from the slates which separate the veins.

There is a broad dyke of porphyry to the west, between the Old Abe vein and the so-called Incline vein of the Homestake, and another dyke of porphyry to the east, which separates the Old Abe veins from the ore in the Giant and Amicus claims. The slates between these two dykes of porphyry divide themselves into a chloritic and hornblendic variety on the western side, and a highly ferruginous micaceous variety on the eastern side. The ore in the former is confined to the three veins of quartz. In the latter, however, the whole mass of slates is impregnated with gold in small quantities, although as yet only the veins of quartz have been found rich enough to extract.

It is in these latter slates—the red slates—that the Palmetto ore was found; but the explorations are still very superficial. A shaft was sunk upon a small seam and a few hundred tons of ore was extracted before the present company took hold of the property. The ore that was found above has not been followed in depth. The value of this portion of the claim is prospective only. The result of one lot of 324 tons worked by the former company yielded \$11,017.08, or \$34 per ton. The seam of ore from which this was produced may widen in depth, but it cannot be expected to average as high as the above yield.

The ore for the mill is now raised through the Far-

ish shaft by a horse-whim. A tramway leads directly from the mouth of the shaft to the mill, and the ore is thus delivered at a very low cost.

Following the Old Abe to the east, are the Giant and Amicus claims. The peculiarity of these claims is the amount of auriferous quartz, both as vein matter and as float, which appears on the surface. This quartz is visible over a large extent of the claim, but becomes especially prominent in the upper or northern portion.

In the Amicus claim it has been cut by a shaft to a depth of 40 feet, which is connected with a tunnel at the bottom. The width of the quartz is not fully proven, but it is over 25 feet. Assays of a lot of this ore gave \$13 per ton.

This same body of quartz has been cut by several drifts on the surface, and it is found to spread over a great width on the top of the divide. Just beyond the divide it has been partially developed in the workings of the Clara No. 1 Company. Even in this place the entire width is not seen, but it is known to be over 45 feet. The yield of the ore from this latter claim has varied from \$5 to \$7.50 per ton.

Judging from these surface developments, the Giant and Amicus claims promise a very large yield of ore.

The Rothschild claim, to the east of the Giant, is valuable to the company for its surface ground, apart from the value of the ore that may be found within

its limits. I am not aware that any prospecting work has been commenced on this claim.

The new Giant shaft is sunk near the dividing line between the Giant and Rothschild claims. This, in time, will become the main working shaft of the company. It is in every way admirably situated for the purpose, as it is sufficiently elevated for all dumping facilities and for the delivery of the ore to the mills. Furthermore, by being placed near the east terminus of the claims, it will ultimately cut through the various seams of ore; for these ore seams, like those of the Homestake, also dip easterly at an angle of about 51 degrees. Thus the deeper the shaft, the nearer will its bottom be to the ore. Each level will require a shorter drift to the veins. At a depth of 800 feet it will cut into the continuation of the Homestake bodies. Suitable machinery will be erected upon this shaft for all future requirements.

It is the intention of the company to develop their ore bodies by drifts from this shaft. When they are cut by these drifts it will be easy to estimate the quantity of ore in sight. There are no means of making any present estimate, except from the large surface developments.

This work will not be delayed very long as the depth of the shaft is already 300 feet, and the sinking is still prosecuted with vigor.

The Highland Mining Company.

This company was incorporated on the 4th day of October, 1878. Its capital stock is \$10,000,000, divided into 100,000 shares of \$100 each.

The property is a consolidation of three claims—the Emma, the Homestake No. 2, and the Highland. A United States patent has been obtained for the latter.

These locations are made along the surface of the mineral belt, but while the Homestake No. 2 follows the line of the main ore bodies, the Highland and the Emma, lying on either side of it, diverge from the general course. They partially overlap the Homestake No. 2 location near the southern end, so that the total width of mineral ground owned by the company is less wide at this end than towards the north. An examination of Maps No. 2 and No. 3 will make a further explanation unnecessary.

This property, like that of the Giant and Old Abe Company, is not yet being worked on a scale commensurate with the immense development of vein matter within its limits. The force of miners now employed on explorations is small, and the work is concentrated on a few points. As soon as the present shafts are carried to the required depth, and the necessary drifts are run to open up the ore bodies, then the force of men will be greatly increased and the ore will be mined on a larger scale.

The company owns a 30-stamp mill, which is on a fork of Gold Run Creek, and which is conveniently situated in respect to the southern end of the claim. A tramway connects the mill with the lower tunnel, and the cost of delivering the ore is slight.

The claims are located on the top of the divide and extend either way down the slopes. The altitude of the entire claim is quite high when compared with the neighboring locations. The summit of the claim is some 530 feet above the Deadwood Creek, and 330 feet above Gold Run Creek. This fact is of double value to the claims. In the first place, there is a large amount of "backs" above the drainage level; and, secondly, the lower tunnel which leads to the mill becomes a deep tunnel as it is driven onward.

The property is being developed on either side of the divide. On the north side, and near the boundary line between the Homestake No. 2 location and the Golden Terra, a vertical shaft is sunk to the level of the Golden Terra tunnel and connects with it. This shaft cuts the vein and passes through excellent ore. The width of the vein is here very great. It consists of two pay strata separated by ore of less grade, and the entire width, over all, was demonstrated to be in the neighborhood of 140 feet. With a large mill it would probably prove judicious to extract the entire width of the vein, as no ore should be left in the stopes which will pay for mining and milling.

A portion of this end of the Homestake No. 2 location conflicts with a claim formerly known as the Golden Terra Extension, but which now is incorporated with the Gopher claim and is owned by a new company.

This new company also claims a portion of the southerly end of the Golden Terra ground. Their title to this ground is being litigated in the Court of the District, and will soon be settled in one way or the other. I know too little of the merits of their claim to refer to the matter at greater length.

This same body of ore through which the shaft of the Highland Company was carried down, was worked upon by the Golden Terra Extension Company and found to be of an excellent grade. The yield varied from \$7.50 to \$10 per ton. The body is also, in all probability, the continuation of the Homestake vein which was described in my remarks on the property of the Homestake Mining Company. If this should prove to be the fact, it will add greatly to the probability of the continuation of the ore bodies to a considerable depth; for so long a shoot of ore could scarcely prove a shallow one.

Intermediate between the two ends of the property, another shaft was started on the Homestake No. 2 location. This has been carried down to the level of the main tunnel, and here connects with the works which open out from that tunnel. These works, in connec-

tion with the tunnel, show up very thoroughly the nature of the vein at the southern end of the Highland property; and this is also clearly shown in the "section through the Highland mine on line of tunnel," which is represented in Map No. 2.

The level of this tunnel is considerably above the level of the open cuts in the ground of the Homestake Company. The same veins are here discovered that have been, and are, producing so largely in the latter property, but they are cut at a much higher altitude. The Golden Star vein is found to have contracted in width, and the pay ore is confined to two seams of quartz. The Homestake vein, on the other hand, has widened from 25 feet, as in the Homestake property, to 160 feet, as represented in the section. The ore, however, is not so rich at this altitude. The whole mass of slates is intermixed with irregular seams of ore which are sometimes parallel to the stratification and sometimes follow the cleavage of the slates. In working these bodies a considerable amount of slate became intermixed with the ore, and therefore the average yield has not been very high. A better class of ore is found below the tunnel. Some of the lower seams were quite rich, and all of it, at the time of my visit, promised to open up well in depth.

The works of development have been chiefly confined to the Homestake No. 2 location, which follows the course of the Homestake vein.

Neither in the Emma location nor in the Highland has there been any explorations undertaken by the present company. The former owners confined their work to the ore near the surface. The Golden Star vein is found in the Emma location, and was prospected in a number of places along its length.

In the Highland ground, near the southern end, a shaft was sunk by the former owners to a moderate depth. This was subsequently connected with the lower stopes from the main tunnel. This shaft proved the existence here of both the Incline vein and the Discovery or Young's vein, which were developed in the ground of the Homestake Company, and are now being mined. They have not been worked in the upper levels except in the neighboring claim of the Segregated Old Abe.

The porphyry dykes are especially prominent in the Highland location. This porphyry is found overlying a cement bed near the top of the Highland shaft, and the whole peak is composed of it.

From the foregoing it may be seen that the veins have only been attacked at short distances below the surface. The great strength of these veins at each end of the claim, and the high grade of ore that is found in the smaller seams of quartz that are enclosed in the slates, are favorable indications of the future wealth of the property, particularly when a greater depth has been attained.

I give below some results obtained in the 30-ton mill of the company from the ore that was extracted near the southern end of the claim. This ore was cheaply mined and milled, but the results are low because of the amount of slate that was intermixed with it:

Amount of ore crushed.....	12,235 tons.
Yield, bullion.....	<u>4,261.69 ozs.</u>
Value—Gold, per oz., \$16.85.... Total.....	\$71,829 19
Silver, “ .13.... “	665 58
	<u>\$16.98</u>
	<u>\$72,494 77</u>
Net yield, deducting charges for insurance, express- age, coining, etc.....	\$71,678 39
Net yield per ton.....	5 86

Since the foregoing was written, I learn that the negotiations which were pending for the purchase of the “Segregated Homestake” property have been successfully terminated. This valuable strip of ground is now added to the other claims of the Highland Company. Its position is indicated upon Map No. 2.

When the present Homestake Company were completing their purchase of the Homestake and Golden Star locations, some of the owners in these claims were unwilling to sell their interest. The matter was finally compromised by giving to these parties a strip of a width of 150 feet off the northern end of the two locations. This is the ground which has just been purchased, and which is known as the Segregated

Homestake claim. A section (No. 3) is given on Map No. 2, which shows the immense development of vein matter within this claim; and the results of the exploration in the past show that enough ore is already proven to insure a profit over and above the cost.

But there is another and a greater advantage arising from the purchase of this ground. There is no longer any break in the succession of claims which are under the same general control. From the De Smet claim in the north, to the southern end of the Homestake property on the south, and even beyond that point, all of the great mineral belt can be developed under one management and on one general system that is sure to inure to the benefit of all the companies, and more especially to the Highland, as a deep outlet is given to their ground through the works of the Homestake Company.

The Golden Terra Mining Company.

This company was incorporated on the 24th day of January, 1878, with a capital stock of \$10,000.000, divided into 100.000 shares of \$100 each.

The position of the property is represented upon Maps No. 1 and No. 2. By referring to these maps it will be seen that the property consists of two locations—the Ophir and the Golden Terra—and that these locations cover a portion of the same ground. The entire length of the company's claim is about 790 feet, and its width varies from 270 to 370 feet. All of this is upon ore-bearing ground. The additional amount of surface given to the property by that portion of the Ophir location which extends beyond the Terra location is 370 feet in length, by an average width of 270 feet. This end of the property is “adversed” by the claims known as the Gopher and the Golden Terra Extension. These claims have recently passed into the hands of a new company. I have already referred to this matter in the preceding description of the Highland Mining Company, and I need only to repeat, in this place, that a suit has been commenced against these parties to recover possession of the ground in dispute.

The situation of the claim is very favorable for easy mining and milling.

To the north, the claim terminates at Bobtail Creek, on which the new mill of 60 stamps has been erected. To the south, the location rises up the spur of the main divide until it unites with the Homestake No. 2 location of the Highland Company. The height of the hill, above the entrance of the upper levels near Bobtail Creek, is about 25 feet; over the end of the Terra location, the height is 130 feet; and over the south end of the entire claim, it is 208 feet. The tunnel, therefore, in being driven a length of, say, 700 feet along the course of the vein, gains a depth of 200 feet below the surface, and thereby acquires a large amount of "backs."

The surface of the ground is generally covered with porphyritic debris. This debris has a varying depth. The veins are found immediately below it, and carry good pay ore from the surface down.

The surface developments, when I visited this property, were confined to some open cuts near the northern end. In addition to this, several shafts had been sunk to the level below for the purpose of ventilation. The Gopher and Terra Extension Company, also, had mined largely in the upper portion of this claim, at an altitude of 130 feet above the upper level of the Terra. These explorations, in connection with the deeper workings of the company, seem to prove that this property embraces three distinct veins.

Commencing on the eastern side, the Gopher and

Terra Extensions appear to be on the continuation of the Homestake vein. This vein passes to the east of the Terra claim in going northerly. It is found in a zone of ferruginous micaceous slate, easily distinguished, near the surface, from the adjoining zone of chloritic slate. In this latter is another body of ore, which, at the time of my visit, had been followed along its course for nearly four hundred feet on the upper level of the Golden Terra mine.

On the west of this ^{zone} zone of chloritic slate, there is another distinct ^{zone} zone of slate, which, like the first mentioned, is micaceous and highly ferruginous; and in this, also, there is a vein of auriferous quartz, which has been followed by drifts for a long distance. While the first mentioned ore body is supposed to be the continuation of the Homestake vein, the second may be the extension of the Golden Star vein, or some other one that takes its place, if that vein thins out before it reaches this claim. There is a still stronger assurance that it is the same vein which passes northerly through the eastern portion of the adjoining Deadwood claim, and thence into the De Smet claim.

In both of these mines this vein is being worked on a large scale, and is yielding handsomely.

The third vein is called the Ophir vein. This, also, is proven in the works of the Deadwood and the De Smet, and is everywhere found to contain good ore.

The ground to the south of the Terra has not been sufficiently developed to show the continuation of the vein in this direction. If it does continue, it lies to the west of the Golden Star vein.

The two last mentioned veins have been prospected in the Terra mine, not only upon the upper level, but upon the lower level, which is some 47 feet deeper. This lower level was run into these veins from the east, and drifts were started to the north and to the south, with very satisfactory results. A west cross drift from the south drift was recently commenced at a point 100 feet to the south of the lower tunnel, and was all in ore at the latest advice.

The amount of ore developed by the various drifts and cross drifts on these two veins is already sufficient to keep the new mill engaged to its full capacity for many months to come. As soon as the company regains possession of the disputed ground, the reserves will be greatly augmented; for the Homestake vein has, in this Terra ground, a total width of above 125 to 140 feet, of which there is a width of 40 or 50 feet of a fine grade of ore.

All of the veins and the slate have an easterly pitch. Their course changes in going northerly and bends more to the west. There are no porphyry dykes in this property. Those which have been described in previous pages pass along these veins, but lie to the eastward, and make their appearance in the

Mammoth Tunnel, which is started from Shoemaker Gulch.

The veins of ore preserve the same general characteristics that they have shown elsewhere on the belt. They widen and contract along their course, and carry from 6 to 40 feet of good milling ore. In places, the proportion of slate to quartz is greater than in others; sometimes the quartz is solid, and sometimes again it is very friable. This friable, or broken quartz, is generally highly stained by the presence of iron, and is then of a better grade than the solid quartz. Both the slate and the quartz in the ore deposits are auriferous.

The slates through which the lower tunnel was driven towards the veins, show that they have undergone a change in depth. In the upper works, and on the surface, they appeared to separate easily in flakes, and were comparatively soft. In depth they form a hard, compact mass, highly siliceous, though quite green from the presence of chlorite. The lines of lamination could scarcely be distinguished. In the neighborhood of the veins, the slate alters again, in its texture. Its lamination is more distinct, but it is much more siliceous than the slates above.

The proportion of sulphurets increases in depth. They consist of arsenical and iron pyrites. Throughout all the veins there is occasionally a notable percentage of magnetic iron.

The new 60-stamp mill of the company was started up on the 26th of June of this year. Prior to this time the company was under the necessity of employing "outside mills" on "custom" work, and thereby lost the amount which represents the profit of these mills, as well as the cost of hauling the ore a considerable distance. Their own little mill of 30 stamps was often obliged to shut down for want of water; but even when the supply was abundant, its capacity was too small for remunerative work.

The new mill is the counterpart of the Deadwood Mill. It was built by Messrs. Fraser & Chalmers, of Chicago, who have ably carried out the plans of the company's engineer. It is so situated that the ore can be delivered by tramway directly to the bins on the upper floor of the mill. Its capacity will vary with the nature of the ore, but the average amount crushed each month will probably be in the neighborhood of 4,000 tons.

The ore that was sent to the various mills in times past was almost entirely obtained from the prospecting drifts that have been run along and across the veins. There was very little breasted out in stopes.

The new mill was started up so recently that no final "clean up" has yet been made of the amount of ore worked in it.

I give below a statement which shows the results obtained from the commencement of operations on

the part of the present company—that is, from January, 1878—until the end of June of this year.

I am obliged to make an estimate of a portion of the total amount of ore crushed.

The accounts show, that the yield of various lots sent to different mills, and aggregating 2,814½ tons, was \$23,715.10, or \$8.42 per ton. Another series of shipments aggregated 7,361½ tons, which yielded \$48,561.15, or \$6.59 per ton. The remainder of the total yield of the ore, say \$53,463.89, I estimate to have been produced from 6,110 tons. This would give an average of \$8.75 for that amount.

The yield will never remain uniform, as the ore is richer in some portions of the veins than in others.

The proceeds in the past, then, were as follows:

Total amount crushed.....	16,316 tons.
Yield, bullion.....	<u>7,620 82 ozs.</u>
Value, per oz., Gold, \$16.635	Total.....\$126,777.60
“ “ Silver, .157	“ 1,196.16
	<u>\$16.79</u>
	<u>\$127,973.76</u>
Net value, deducting all charges for expressage, insurance, coining, etc.....	\$125,740.14
Net value per ton.....	7.70

The cost of mining and milling the ore will be treated of in more detail in my remarks on the Deadwood property, as the conditions existing in the two mines are nearly similar. The maximum cost for the

large bodies of ore, which are now exposed in the mine, should not exceed \$3.00 per ton, and may fall as low as \$2.50.

The saving to the company, by the reduction of their ores in the new mill, as compared with the cost of employing "custom mills," will itself be the equivalent of a large annual dividend. A greater advantage than this, however, is the possibility of working very low grade ores to a profit. Ores that yield but \$4.00 to the ton, might give annual profits to the amount of \$60,000 and upwards under the conditions which now exist.

The Deadwood Mining Company.

This company was incorporated on the 4th day of October, 1878. The capital stock is \$10,000,000, divided into 100,000 shares of \$100 each.


The property consists of the northerly portions of the original Golden Terra and Ophir locations, and it includes all that portion on the main line of deposits on the mineral belt which lies between the Golden Terra Company on the south, and the De Smet Company on the north. The length of the claim is 1,010 feet; the width at the southern end is about 375 feet, and at the northern end about 290 feet. Its relative position to other claims, as well as some of its topographical advantages, can best be understood by referring to the accompanying Maps, No. 1 and No. 3.

At the time of my examination, the works of the company were confined to the southern end. Apart from the satisfactory results obtained from these developments, additional assurance of the value of the claim in the future is afforded by the fine developments of ore bodies in the claims to the north and to the south. The same division of the slates into distinct bands with distinct veins that is noticeable in these other claims, is also observed in the Deadwood; and the veins which are yielding so largely in these other claims, are also yielding largely in that portion of the

Deadwood which is now being worked. Thus the continuity of the veins throughout the whole length of the claim is almost completely demonstrated.

The topographical features of the property resemble those of the Golden Terra, and greatly facilitate the extraction of the ore at a low cost. The claim is upon the spur of a hill, which rises rapidly towards the north. The southern end terminates at Bobtail Creek. From this point a tunnel has been commenced, which will ultimately reach the northern end of the claim. The altitude of the tunnel is about 280 feet above Deadwood Creek—which may be assumed as the natural drainage level of the district—and the height of the peak, near the northern end of the claim, is 240 feet above the tunnel level. This, then, is the depth that the tunnel will gain in its 1,000 feet of length. The tunnel, moreover, is the tramway tunnel over which the loaded cars are hauled directly to the upper floor of the mill. All the ore extracted above its level requires little or no handling; and the quantity of ore in these upper bodies appears to be very large.

The geological features of this claim need only to be referred to in brief. The hillside is covered with debris of porphyry to a varying depth, and the veins are hidden from view. The peak of the hill, and the the top of the ridge for some distance either side, is composed of cement beds lying under sandstone, and all of it has a covering of porphyry. The depth of



these layers to the slate formation below is proven to be over 40 feet in one place, and, in others, may reach 75 feet. The porphyry is not from any dyke within the claim. As far as ~~that~~ *the claim* has been explored, its whole width is over mineral bearing slates. On the west side is the band of ferruginous slate with an ore body which divides itself into two seams of pay ore, each being about 10 feet in width. This forms the Ophir vein. On the east side is the band of chloritic slate with the bodies of ore upon which the large open cuts of the claim have been excavated, and is considered as the Golden Star vein. These large bodies become narrow in depth, but are found to open into broad masses again, further into the hill. There appears to be a series of these widenings and contractions both in length and in depth.

There is one peculiarity of the vein structure which is better developed in this Deadwood claim than in any I have described. This is the deposition of the auriferous quartz in solid veins along the jointing planes of the slates; that is, while the pay ore, as a mass, follows the stratification of the slates in depth, there are local depositions of the quartz at right angles to this stratification, and the appearance is given of a number of almost parallel veins of a few feet in width, making to the west instead of to the east in depth; but they all terminated with the foot wall of the true course of the ore deposit.

The ore that has been mined came chiefly from the open cuts. The lower one was driven in on the veins until its height at the back end became too great, and then a second one was started above this and continued in the same way. From the end of this latter, the ore is followed and worked out in a series of chambers. The mass of surface porphyry is left untouched. This, which forms the roof of the deposit, must be supported.

The ore from these chambers is dropped through chutes to the cars in the lower tramway. These are hauled by horses to the upper floor of the new 60-stamp mill of the company. This mill is so situated, and so constructed, that a few hands perform all the requisite labor. It is admirably planned, and is, in all respects, a model gold mill. The capacity of the mill is nominally 4,000 tons monthly, but the amount crushed will vary with the nature of the ore. The mill was started up on the 17th of February of this year, and all the ore that the mine has since produced has been worked in it to the exclusion of outside or "custom mills."

Previous to this time, the company was obliged to employ a number of these "custom" mills. The saving effected by the possession of the new mill is very decided, as may be seen from the figures I give further on.

The quantity of ore that may be extracted from the ore "in sight" appears to be very large, and sufficient for the full capacity of the mill for many months to come. The bodies, however, are breasted out along their course, and are not cut in various directions by drifts. I have no means, therefore, of estimating the quantity in figures.

The results obtained in the past (to June 30th, 1879) are as follows:

Total amount crushed	35,992 tons.
Yield, bullion	<u>15,887.84 ozs.</u>
Value—Gold, per oz., \$17,444... Total.....	\$277,165 40
Silver, " .138.... "	2,201 09
	<u>\$17.58</u>
	<u>\$279,366 49</u>
Net yield, deducting for expressage, insurance, coin-	
ing, etc.....	\$274,132 99
Net yield per ton.....	7 62

The yield per ton has varied in the different lots worked, from \$5.79 to \$10.36.

Having the new mill, and this being conveniently situated, there is no necessity for assorting the ore. All is worked as it is mined, and all is found to yield a good profit.

To give an idea of the cost working, and also to show the advantage to the company in crushing their ore in the new mill as compared with custom mills, I

here submit a statement, furnished me by the officers of the company, of the working expenses from the commencement of operations to the month of April of this year:

1. OLD DEADWOOD MILL:

Production (no record of tons).....	\$2,980 53
Cost, opening mine and crushing.....	13,938 25

2. CUSTOM MILLS (June, 1878, to February, 1879, both included):

Production, 17,695 tons, yield.....	\$133,325 31
Yield per ton.....	7.534
Cost—Extracting.....	\$10,553 76
Hauling and crushing.....	56,781 97
Prospecting and deadwork	9,265 10
Expense.....	2,899 22—
	79,500.05
Cost per ton.....	4.718
Net yield above cost, per ton.....	2.816

3. DEADWOOD NEW MILL (to end of March, 1879):

Production, 5,580 $\frac{1}{2}$ tons, yield.....	\$39,891.69
Yield per ton.....	7.129
Cost—Extracting.....	\$2,688 20
Hauling the ore.....	753 30
Crushing the ore.....	6,544 58
Prospecting and deadwork..	588 28
Expense... ..	517 00—
	11,091.35
Cost per ton.....	1.982
Net yield above cost, per ton.....	5.144

The difference in the net yield is, according to the above, \$2.328 per ton in favor of the new mill. This

difference will vary with the difference in the grade of the various lots of ore that will be worked; but the saving effected will amount every year to more than the cost of the mill. It can scarcely be expected, that the total cost of mining and milling will remain as low as \$2.00 per ton. The milling cost should not vary materially from month to month, but the mining cost must vary with the amount of deadwork and the amount of timbering, etc., that may be required. But it is easy to see that the company is able to work a very low grade of rock to a profit; and that ore, which will equal the average yield of all that has been worked in the past, will realize to them an excellent monthly dividend.

Conclusion.

From the foregoing representation of the present condition of the various mines on the mineral belt, it may be readily seen that the respective companies have prosecuted the works of exploration with great vigor. The mines are still in their infancy, and a large portion of each claim is yet untouched; but the quantity of ore "in sight" in each mine is already very large. Mills of great capacity have been erected as fast as the mines have justified the expenditure, and each mill is now assured of a steady supply of ore for a long period of time. The great abundance of the ore compensates for its low grade. As it is advisable to work all the ore that will more than pay for the working expenses, it is likely that the yield—while it may sometimes average \$10 or \$12 per ton—will usually vary from \$7 to \$9 per ton. But the cost of mining and milling is only from \$2 to \$4 per ton—the latter figure being the maximum cost yet incurred—and there is, consequently, an ample margin for profit.

Respectfully submitted,

LOUIS JANIN, M. E.

SAN FRANCISCO, July, 1879.



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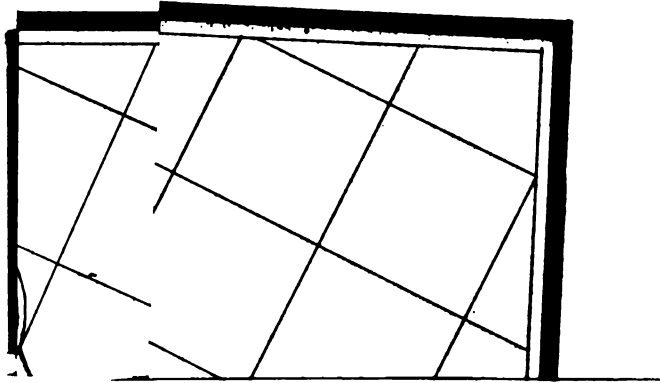
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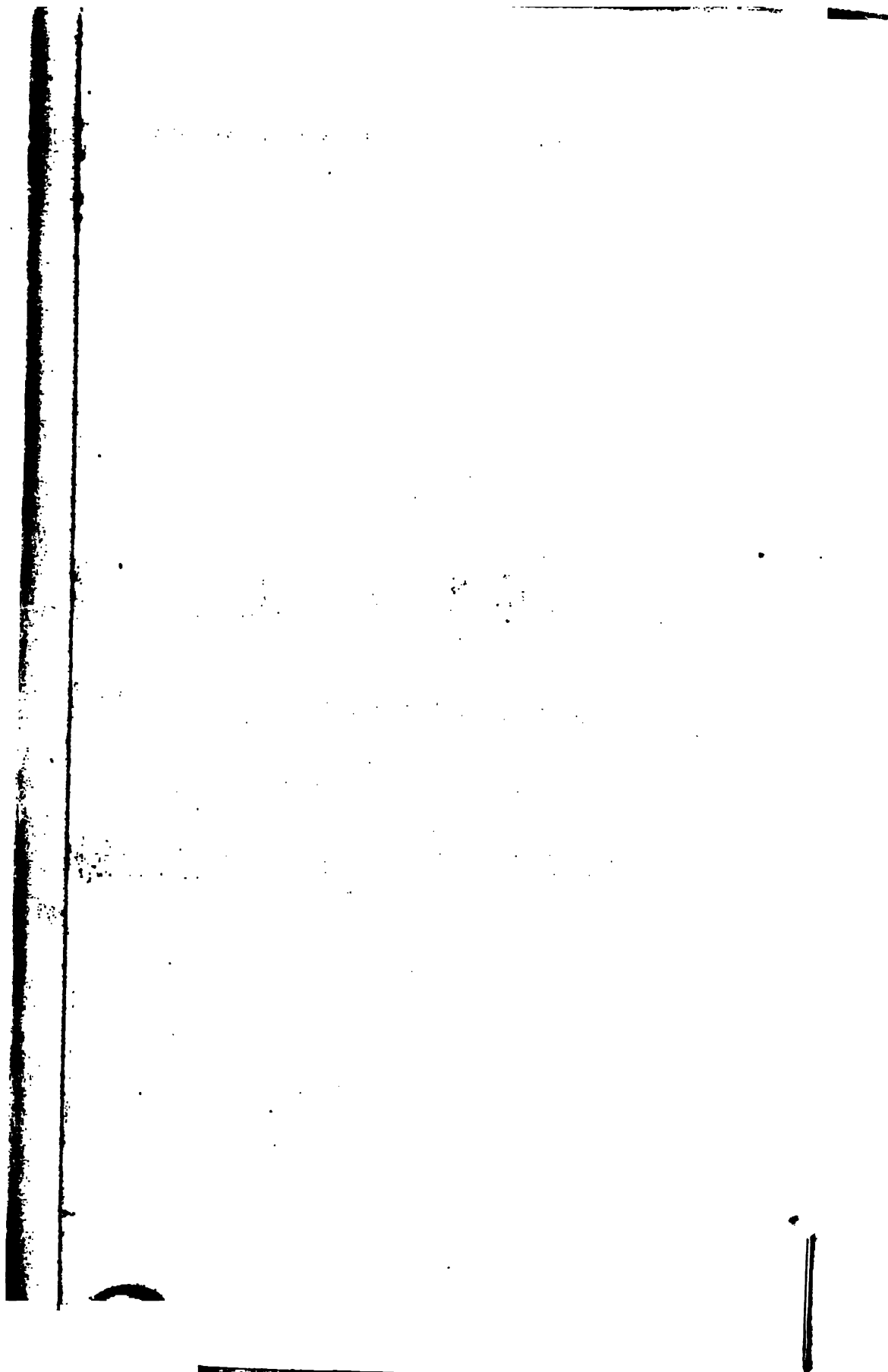
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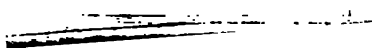
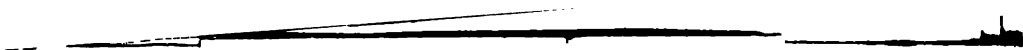
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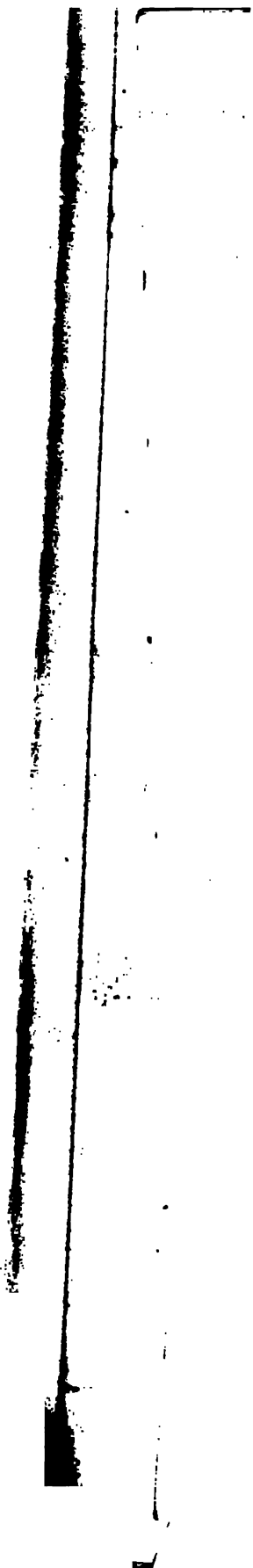
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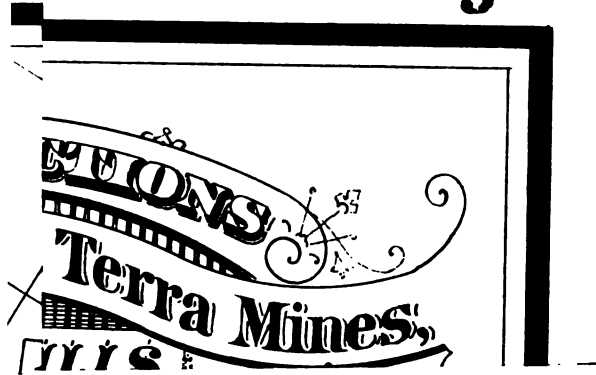
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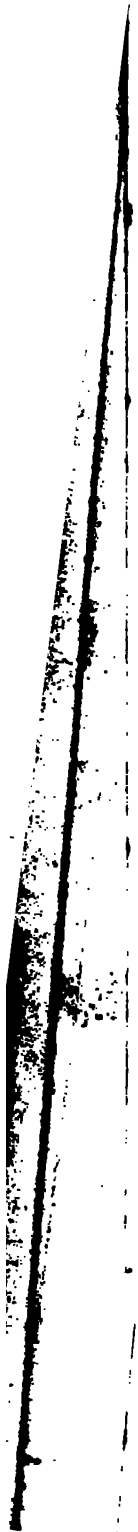




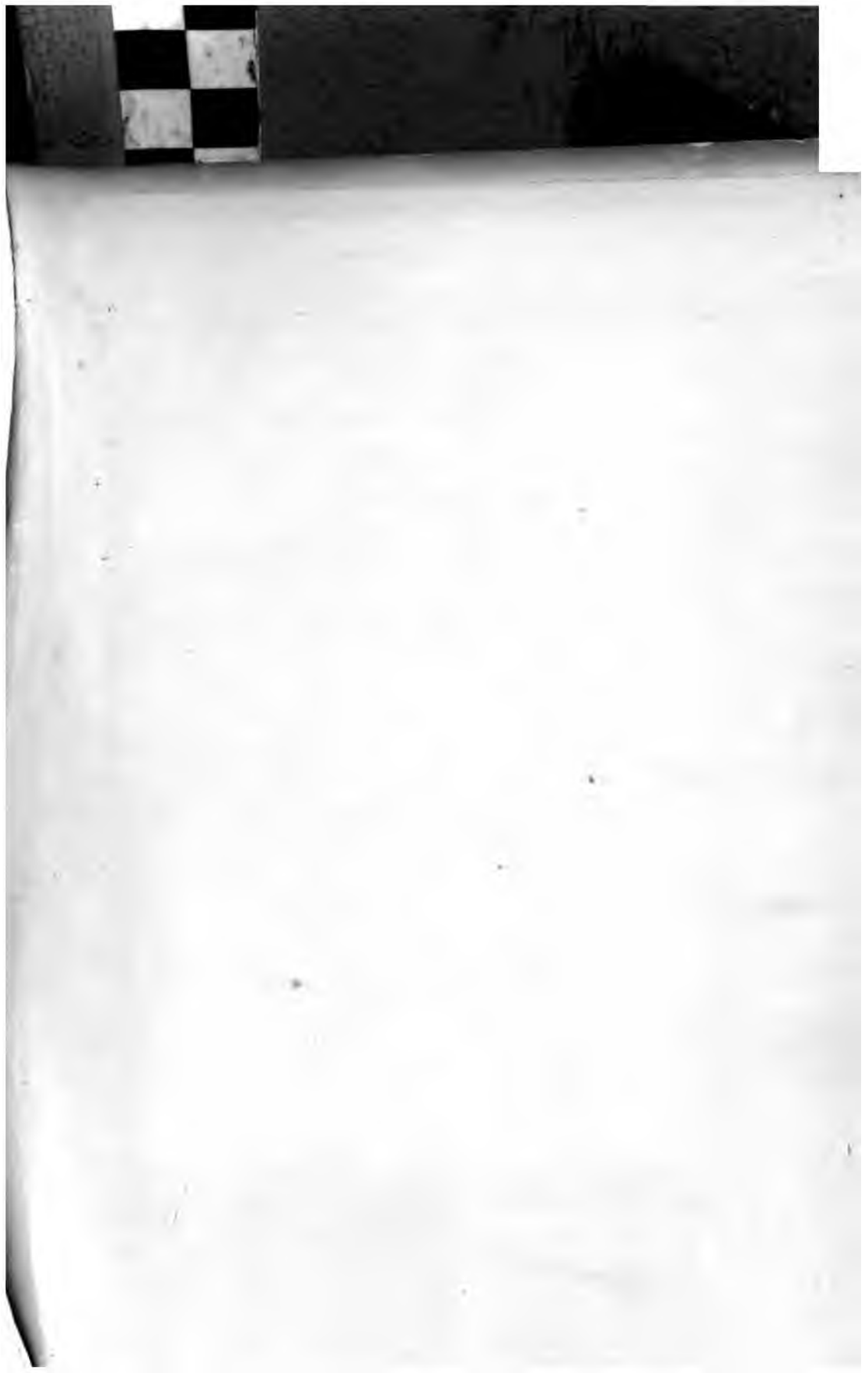


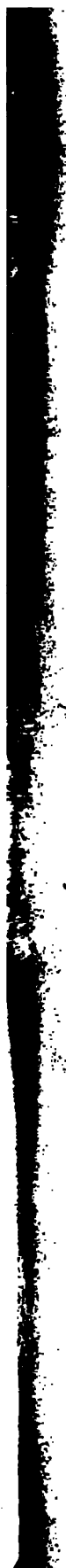


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